

CLAIMS

1. A method for the preparation of paper pulp from used papers previously disintegrated and put in suspension by a pulpier, using the difference between the sedimentation speed of the different particles contained in the suspension under the effect of an artificial gravity field created by rotation combined with a filtration action, the method comprising the combined and simultaneous accomplishment, in one single rotary apparatus, of the following stages:

- a) Filtration of the suspension through a grate (6) who retains at least a part of the fibres contained in the suspension and allows the major part of the water and small contaminants and mineral loads contained in the suspension to pass, being that filtration aided by the force created by the acceleration resulting from the rotation of the apparatus;

- b) Concentration and evacuation of the part of the suspension retained by the grate (6) at the periphery of the apparatus under the effect of the acceleration resulting from the rotation the apparatus;

- c) Clarification of the water which passes through the grate (6) by separation of the solid elements in suspension with density higher than 1 which sediment at the periphery of the apparatus under the effect of the acceleration resulting from the rotation of the apparatus;

- d) Concentration and extraction of solid elements of density higher than 1 separated from the water which passes through the grate (6).

2. Apparatus to perform the method described in claim 1 for the preparation of paper pulp from used papers previously disintegrated and put in fibrous suspension by a pulpier, comprising the apparatus a body (1) rotating at high speed driving together all components inside it, the body (1) comprising:

- a) An inlet pipe (2) for the fibrous suspension located at the centre of the body (1), being the fibrous suspension driven at the angular speed of the body by means of blades (3) solidary with the body (1);
- b) A feeding zone (4) of a filtration grate (6) into which the fibrous suspension introduced in the body (1) of the apparatus is driven, being the grate (6) provided with small holes which allow to retain at least a part of the fibres contained in the suspension while the major part of the water, small contaminants and mineral loads contained in the suspension pass through the grate (6);
- c) A zone (7) for the concentration of the part of the suspension retained by the grate (6) located at the periphery of the feeding zone (4) of the grate (6);
- d) Several apertures (8) located at the periphery of the body (1) of the apparatus to evacuate the concentrated suspension from the concentration zone (7);
- e) A clarification chamber (16) to clarify the water having passed through the grate (6), the clarification chamber (16) including apertures (20) located at the periphery of the apparatus body (1) for the evacuation of the solid elements having sedimented at the

periphery of said chamber (16) and a central pipe (21) for the evacuation of the clarified water.

3. Apparatus according to claim 2 and characterized by the apparatus comprising also one or several tubes (44) bent in a snail shape at the outside of the body (1), whose inlets are located facing the apertures (8) for the evacuation of the concentrated suspension retained by the filtration grate (6).

4. Apparatus according to claim 2 and characterized by the apparatus comprising also one central pipe (22) aimed to collect and evacuate from the apparatus body (1) the solid elements, present in the fibrous suspension and retained by the filtration grate (6), which migrate to the centre the apparatus.

5. Apparatus according to claim 2 and characterized by the clarification chamber (16) comprising separation cones to facilitate the separation and migration of solid elements present in the water to be clarified.

6. Apparatus according to claims 2 and 5 and characterized by the separation cones of the clarification chamber (16) being prolonged in their peripheral part by channels (17) for the evacuation of separated particles having a density higher than 1, these channels communicating with a pipe (18) ending in a concentration chamber (19), at the periphery of the clarification chamber (16).

7. Apparatus according to claims 2 and 5 and characterized by the separations cones of the clarification chamber (16) being prolonged in the direction of the apparatus axis by channels (36) for the evacuation of separated particles having a density lower than 1, these channels ending in a central pipe (37) for the evacuation of the separated particles.

8. Apparatus according to claim 2, and characterized by the body (1) of the apparatus also comprising a device for the recovery of cellulosic particles having passed through the filtration grate (6), said device being constituted by:

a) A sedimentation chamber (5), immediately downstream the filtration grate (6) and at its periphery, where the major part of the heavy contaminants and cellulosic particles having passed through the filtration grate (6) sediment, under the effect of the artificial gravity field created by the rotation of the apparatus;

b) A pipe (10), whose connection is located at the level of the sedimentation chamber (5) and which is oriented to the apparatus body centre (1), collecting the particles and contaminants that have there been sedimented, and dimensioned so that the flow speed in this pipe be higher than the speed of migration of the cellulosic particles to the periphery, while the heavier contaminants sediment at the periphery of said pipe (10);

c) A central pipe (14) collecting, near the axis of the apparatus, the flows of the pipe (10), mentioned at the previous paragraph and allowing their evacuation from the apparatus body (1) by its axis.

9. Apparatus according to claim 2 and characterized by the apparatus comprising an inlet pipe (13), which allows the introduction into the fibrous suspension, at the inside of the apparatus body (1), solid elements in points (13b) located upstream the filtration grate (6) and at the periphery of the feeding zone (4) of said grate (6).

10. Apparatus according to claims 2 and 9 and characterized by the filtration grate (6) being equipped

with apertures of smaller dimension in the most peripheral part.

11. Apparatus according to claims 2 and 5, and characterized by the clarification chamber (16) being divided in two chambers functioning in series, both equipped with cones and separated by a central conical wall (35).

12. Apparatus according to claim 2, and characterized by the body (1) of the apparatus comprising a preclarification chamber (33), immediately upstream the clarification chamber (16), aimed to separate the coarser solid elements before the final clarification of the water.

13. Apparatus according to claims 2 and 12, and characterized by the body (1) of the apparatus comprising apertures (34), at the periphery of the preclarification chamber (33), to evacuate from the apparatus body (1) the solid elements which sediment at the periphery of said chamber (33).

14. Apparatus according to claims 2 and 12 and characterized by the body (1) of the apparatus comprising inclined deflectors (39), fixed or adjustable, ensuring a communication between the periphery of the preclarification chamber (33) and the concentration chamber (7) of the suspension portion retained by the filtration grate (6).

15. Apparatus according to claim 2 characterized by the body (1) of the apparatus comprising a sedimentation device upstream the filtration grate (6), in order to make a separation of some contaminants with big dimensions contained in the fibrous suspension introduced in the apparatus, said device being constituted by:

a) A sedimentation chamber (25);

b) An hole (22b) located in the part closer to the axis of the sedimentation chamber (25), aimed to separate the light elements which there concentrate and driving them to the central pipe (22) and allowing their elimination;

c) An hole (26) located at the periphery of the sedimentation chamber (25), aimed to separate the heavy elements, including cellulose fibres, which there sediment;

d) A pipe (27) deriving the part of the fibrous suspension having passed into the chamber (25) and having not been separated by the holes (22b) and (26) of separation of light and heavy elements, into the feeding zone (4) of the filtration grate (6), or to the following stage of the method, if a complementary device is located between the sedimentation device and the filtration grate feeding zone; said pipe (27) having an inclination and section adapted so that the cellulosic elements are driven by the flow without sedimenting there;

e) A pipe connecting the hole (26) for the separation of heavy elements to the pipe mentioned in the previous paragraph;

f) A hole (30) for the elimination of heavy elements, in the peripheral part of the pipe (27) mentioned at paragraph d), aimed to collect and separate the heavier contaminants which sediment at the periphery of said pipe (27);

g) A pipe leading the solid elements captured by hole (30) for the elimination of the heavy elements mentioned at paragraph f) to the apertures (38), located at the periphery of the body (1), for the

evacuation of the elements collected by said hole (30).

16. Apparatus according to claim 2, characterized by the apparatus body (1) comprising a classifier device upstream the filtration grate (6), aimed to separate the contaminants having a dimension higher than the cellulose fibres, said apparatus being constituted by:

- a) A classifier grate (23) having a flat or conical shape and having calibrated slots or holes such that the majority of the cellulose fibres pass through the slots and/or holes;

- b) Apertures (38) located at the periphery of the apparatus body (1) and upstream the classifier grate (23), allowing to evacuate the elements, which do not pass through the slots and/or holes and migrate to the periphery of said grate (23);

- c) A central pipe (22) aimed to collect and evacuate from the apparatus body (1) the elements, which do not pass through the slots and/or holes, and migrate to the axis of the apparatus;

- d) A pipe (24) leading the water and the elements having passed the classifier grate (23) to the feeding zone (4) of the filtration grate (6).

17. Apparatus according to claims 2 and 16 and characterized by the apparatus body (1) comprising a device for the derivation of a part of the water, upstream the classifier grate (23), said apparatus being constituted by:

- a) A water inlet (29) having a conical shape and oriented perpendicularly to the trajectories of the particles, located at the periphery and upstream the classifier grate (23);

b) A pipe connecting the water inlet mentioned at the previous paragraph and the clarification chamber or the feeding zone (4) of the filtration grate (6), according to the uses.

18. Apparatus according to claims 2 and 16 and characterized by the classifier grate (23) being conical and including one or several inclinations (28) in order to avoid the accumulation of solid elements along the classifier grate (23).

19. Apparatus according to claims 2 and 16 and characterized by the holes (40) of the classifier grate (23) having a radial direction and an entrance with the shape of a funnel, the entrances with the funnel shape of two adjacent holes joining themselves at the side upstream the grate in order to avoid any plane surface between two holes, and this being done to facilitate the orientation and the passage of the fibres.

20. Apparatus according to claims 2 and 16 characterized by the holes (40) of the classifier grate (23) being comprised by an inlet funnel and an outlet funnel in order to facilitate the passage of the fibres and avoid the risk of clogging.

21. Apparatus according to claim 2 and characterized by the holes of the filtration grate (6) being calibrated to allow the passage of an important part of the short cellulose fibres and retain the majority of the long cellulose fibres, performing therefore a fractioning between short fibres and long fibres.

22. Equipment according to claim 2 and characterized by the apparatus comprising a central pipe aimed to lead directly to the inside of the apparatus body (1), at the level of

the clarification chamber, some non-thickened semi-liquid effluents such as the foams of a de-inking cell.